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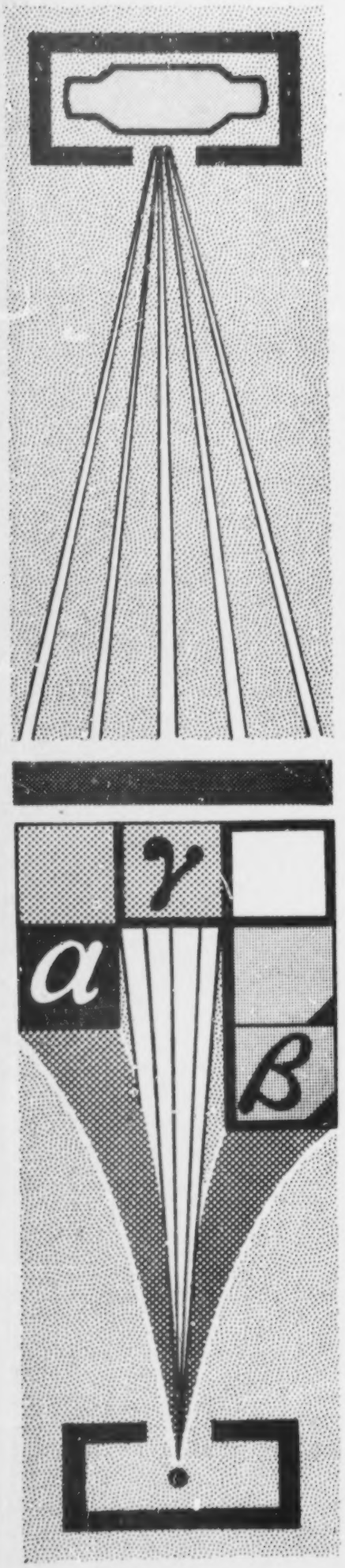

RADIUM DISPOSAL PROJECT

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

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RADIUM DISPOSAL PROJECT

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RADIOACTIVE MATERIALS SECTION
MEDICAL and OCCUPATIONAL RADIATION PROGRAM

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service
Bureau of Disease Prevention and Environmental Control
National Center for Radiological Health
Rockville, Maryland 20852

RADIUM DISPOSAL PROJECT

Background

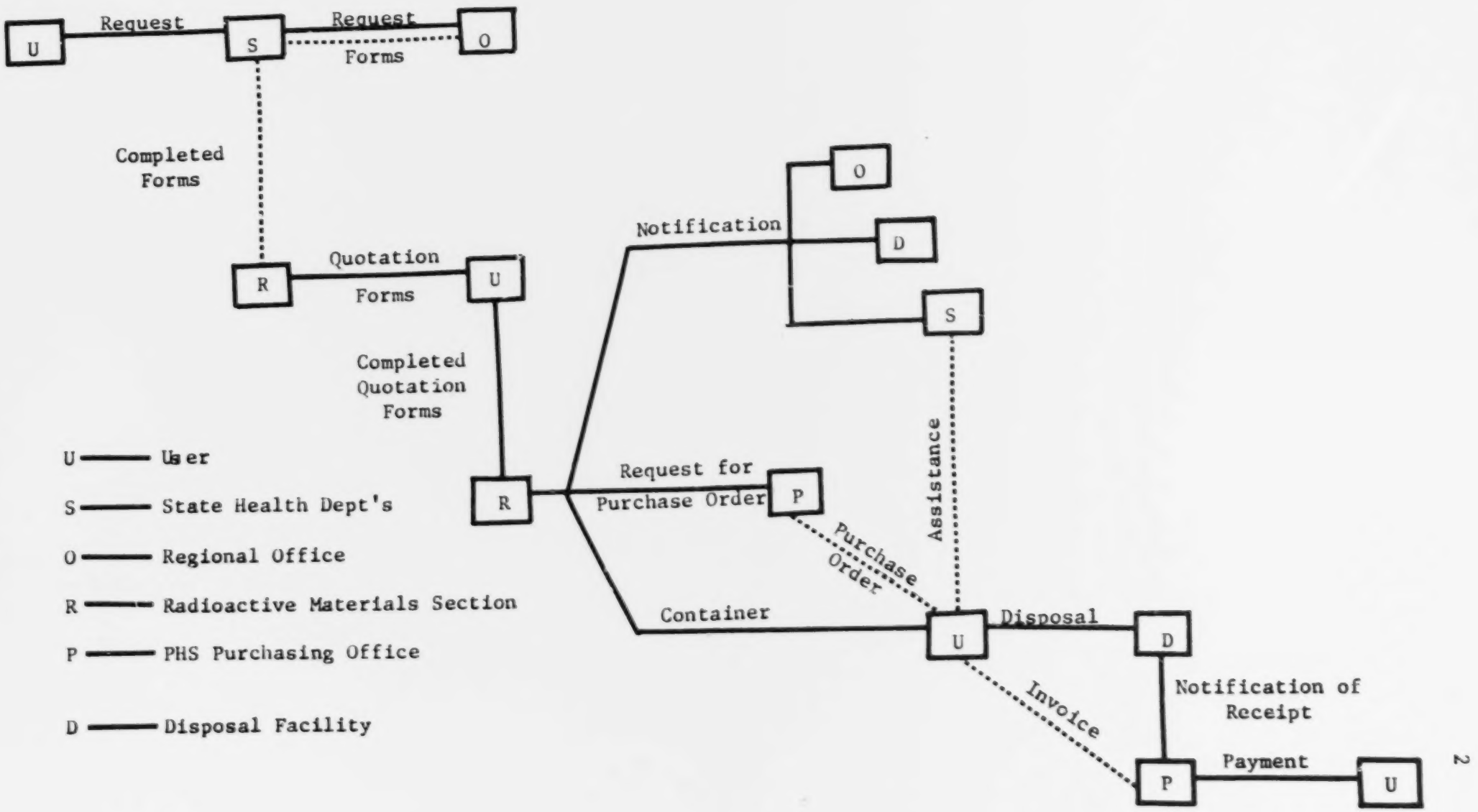
Disposal of surplus, unwanted and/or leaking radium sources has posed a problem for many radium users. State radiological health personnel, while desiring the removal of these sources from usage, did not always have a mechanism available to aid in this disposal. As a result, the user was left in the unfavorable position of paying to dispose of a source he felt retained certain value. His willingness to act under these circumstances could be further frustrated by shipping and container regulations with which he was required to comply. In an attempt to reduce this disposal problem, the Radioactive Materials Section in February of 1965 initiated a radium disposal project.

The procedure followed by the Radioactive Materials Section under the disposal project was to purchase unwanted radium sources for a nominal one dollar value, provide shipping containers, instructions, disposal facilities, and assume transportation cost. State health departments assisted in arranging for the disposal of the sources and assuring that loading and shipping instructions were followed. Thus, the cost to the user was only that of the source and time expended. Because of legal and purchasing procedures already in existence, the user could not donate the source to the Public Health Service without administrative complications. Shipping charges paid by the user were reimbursed by the government after the source was received (the government could only assume responsibility after the source was received). Figure 1 indicates the procedures that were followed on each shipment.

Pre-planning dictated direct participation by the Radioactive Materials Section in waste disposal only until other acceptable means were available.

The Southeastern Radiological Health Laboratory at Montgomery, Alabama and the Radiological Health Laboratory at Rockville, Maryland were utilized as interim storage locations for the sources. As part of a small contract with the General Electric Company, a number of sources were transported to G.E.'s Vallecitos Nuclear Center facilities for testing and disposal. Under a subsequent contract, sources will be collected directly by G.E. and used for source integrity testing. As a result the role of the Radioactive Materials Section in radium disposal will now be that of coordinating activities rather than the active one that had been assumed in the past.

Figure 1 Radium Disposal Procedure



Disposal Activities

As of October 1966, the project had accounted for the disposal of and/or is in the process of disposing of 624 discrete sources totaling 42,491 milligrams of radium. Table 1 summarizes by types of sources, number and activities, the sources that have passed into the disposal system.

Table 1 Sources Entering Disposal System

Type of Source	No.	Mg.
Needles	100	808
Plaques	51	498.2
Cells	72	59.6
Tubes & Capsules	31	571.8
Nasopharyngeal Applicators	3	147.4
Total Medical	257	2085
Static Eliminators	18	32.3
Luminous Compound Kits	306	31
Industrial	12	604.5
AEC Research	31	39,738
Total	624	42,490.8

Three areas of particular interest in which the Section was involved are mentioned below.

1. Luminous Compound Kits

The General Services Administration had accumulated 306 federal surplus kits containing radium luminous paint at three of its supply depots. Working with GSA, the Section arranged to dispose of all the material and at the same time perform a radiation survey of the affected depots. Each kit contained approximately 100 micrograms of radium with a surface dose rate of 50-100 mr/hr and surface alpha contamination of 100-2000 dpm. The kits were isolated and the storage areas posted until the material could be collected. Although contamination was usually limited to storage containers, in one depot it reached 50,000 dpm on a work bench and necessitated decontamination. Where surplus kits had been previously released to individuals, the appropriate State health departments were notified.

2. AEC Activities

Thirty-one of the sources totaling approximately forty grams of radium entered the system via AEC contractors. These include a variety of high activity sources of various types of encapsulation. A large majority of these were neutron sources. Because of the difficulty in maintaining control over the use of the radium if it were released to the general public, these sources will be stored for the present at the SERHL.

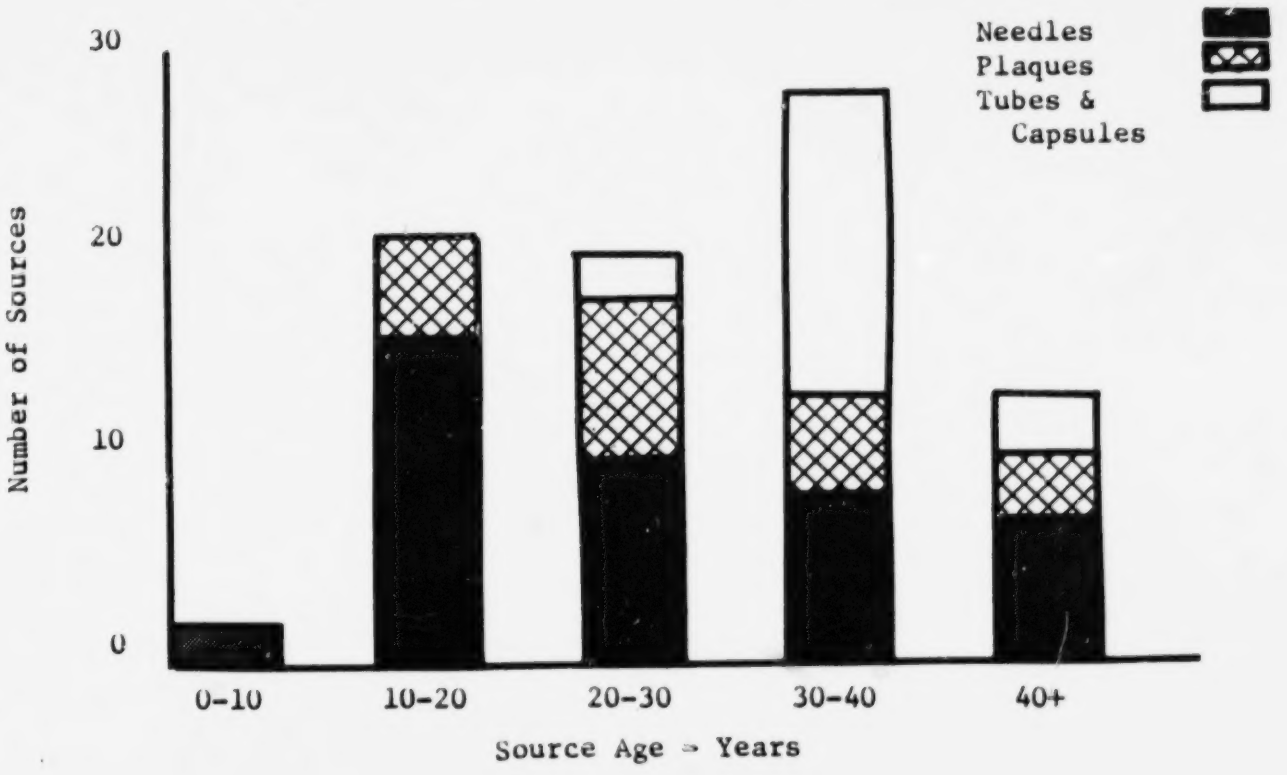
3. Radium Preparations

One hundred and nine bottles containing radioactive powders and tablets were disposed of with the cooperation of the Food and Drug Administration and the responsible health agency. Although the majority of the bottles contained radium bromide and radium chloride powder, several contained radium bromide tablets. Laboratory analysis is being performed to establish the activity of the various dilutions. Field measurements indicated the activity was low with beta-gamma measurements averaging less than 2 mr/hr at 1/2 inch from the surface of the bottles.

Medical Source Data

The following figures and tables have been complied from the information supplied on the "Request for Radium Transfer" form completed by the shipper for each source. Sources previously used in brachytherapy are the only ones included in the data, since most of the industrial sources were one-of-a-kind and/or complete information was not available. Figure 2 shows the age distribution of needles, plaques, tubes and capsules.

Figure 2 - Medical Sources by Age Groupings



Although 192 Medical sources are included in these categories, the ages of only 82 were known. The majority of these sources were over 20 years old with 90% of the tubes and capsules older than 30 years.

The frequency of source leakage is tabulated in Table 2. This information was also obtained from the shipper and was contained on the "Request for Radium Transfer" form. The column headed "Unknown" represents sources that were not leak tested individually. Either they were part of a group leak tested collectively where at least one source had indicated leakage or contamination surveys of the storage area had indicated possible leakage. As has been observed in other studies, plaques showed the largest percentage of leakers. As several methods were used by the different State health departments in determining source leakage, no quantitative definition of source leakage can be given.

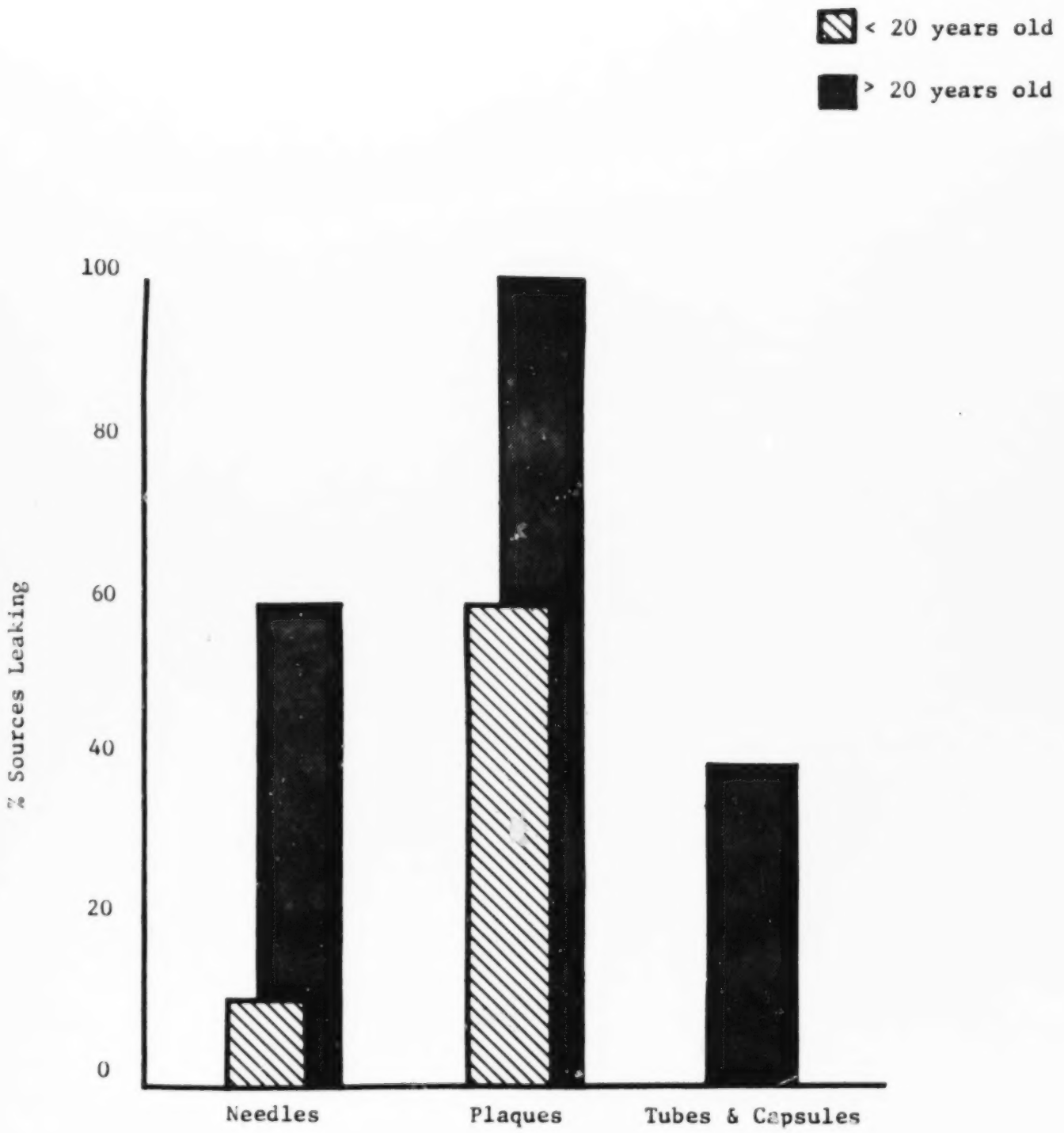
Table 2 Medical Source Leakage

Type Source	Leaking	Not Leaking	Unknown	Total Sources
Needles	32%	35%	33%	100
Plaques	82%	8%	10%	51
Cells	--	7%	93%	72
Tubes & Capsules	42%	45%	13%	31
Nasopharyngeal Applicators	67%	33%	--	3
Total	35%	23%	42%	257

The frequency of leakage for sources less than and greater than 20 years of age is shown in Figure 3. Needles over 20 years old leaked six times as frequently as needles less than 20 years old. All of the plaques greater than 20 years old and 60% of those under 20 years old had been indicated as leaking. Although all the tubes and capsules collected were over 20 years old, only 40% were leaking which was considerably less than those in the other two categories. Since tubes and capsules are of greater wall thickness then needles, and are used in applicators rather than being directly inserted in tissue, they should be less susceptible to leakage.

The sources collected are being used in various studies prior to disposal. These studies, including leak testing methodology, source contamination and decontamination, and source integrity testing, are being performed to gain an understanding of what actions can be taken to minimize the problems associated with the use of radium. The results of these studies may also suggest the need for improved source encapsulation techniques.

Figure 3. Leaking Source by Age Groups and Categories



Conclusion

Since February 1965, the Radioactive Materials Section through the radium disposal project has been instrumental in the collection and disposal of 624 radium sources totaling 42,491 milligrams of activity. These sources included 306 luminous compound kits, over 250 medical sources and in addition over 100 bottles containing radium powders and tablets.

The purpose of the project was to aid States in the disposal of unwanted radium sources where other mechanism were not readily available. As a result of a contract with the General Electric Company, part of which includes collection of unwanted sources, the Section is no longer directly involved in the handling and shipment of the sources. However, the Section remains the coordinating agency.

Data supplied with the sources is tabulated in the report with special consideration given to medical sources. Prior to final disposal of the sources, they will be utilized in studies designed to better understand the problems associated with source encapsulation.